Small Dam Removal Economics

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Small vs. Large Dams

Kamrath Dam
Onion River, WI

Lower Granite Dam
Snake River, WA

- More than 650 dams have been removed in the U.S.
- The majority of them have been under 15 ft. high

"Small" Dam (Economic) Definition: locally managed

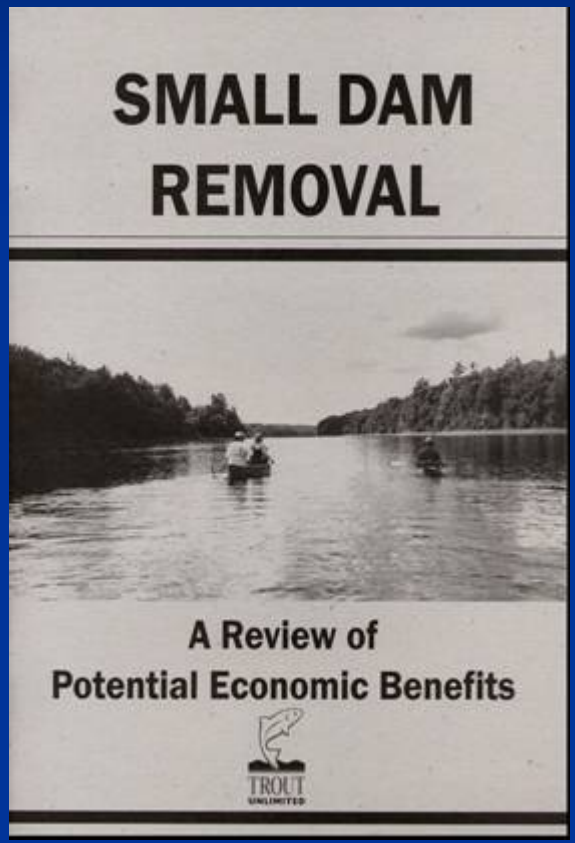
Importance of Economic Issues

Ward Dam removal, Prairie River, WI

Importance of Economic Issues

- Key decision-making point
- Past removals:
  - Safety has often been trigger
  - Economics the decision point, despite emotion
- Future removals:
  - Water quality and habitat?
  - From where does the funding (and staffing) come?
- Simply put, dam removals are economically driven

Some Caveats



- Not an exhaustive economic analysis on dams and dam removal – expectation is not to complete such an analysis at each site, but broaden thinking beyond initial costs
- Raise economic issues and highlight potential benefits
- Much of research to date relates to former millpond dams in Wisconsin

State of Economic Research

Naugatuck Riverkeepers, CT

- Practice has preceded the scientific research
- A century of dam removals with very little data collection
- What does exist? Pre-removal studies
  - Willingness to pay
  - Impact predictions
- Only one (not-yet-published) study looks at actual post-removal economic impacts

Outline of Dam Removal Economics

Kamrath Dam removal, Onion River, WI

- Direct cost comparison: repair vs. removal
- Relief from financial burdens of dam ownership
- Opportunities for economic growth from dam removal
- Property values of nearby properties

Small Dam Removal vs. Repair Costs

Plymco Dam, Town Brook, MA

Repairing an aging dam has averaged 3 times the cost of removal

- Based on 31 cases
- Including repair estimates to bring dam to modern safety standards or to provide required fish passage

Repair versus Removal Costs

failed dam, Chicopee, MA

- In several cases, repair cost estimates were more than 10 times removal costs
- In addition, repair costs are often underestimated
- Will the trend continue?
  - Depends on what is included in the costs – restoration costs?

Repair vs. Removal Cost Examples

Dam (removal date)	Estimated Repair ($)	Removal Cost ($)
Lake Christopher Dam, CA (1994)	160,000	100,000
Edwards Dam, ME (1999)	9,000,000	2,100,000
Grist Mill Dam, ME (1998)	150,000	56,000
Sandstone Dam, MN (1995)	1,000,000	208,000
Two-Mile Dam, NM (1994)	4,100,000	3,200,000
Rat Lake Dam, WA (1989)	261,000	52,000
Waterworks Dam, WI (1998)	694,600	213,770
Mounds Dam, WI (1998)	3,300,000	500,000
Newport No.11 Dam, VT (1996)	783,000	550,000

- Includes costs for repair or required fish passage
- Using low-end estimates for repair

"Blow and Go" Approach

former Centerville Dam impoundment, Cleveland Creek, WI

- Are dam removals getting more expensive?
- More analysis going into projects
- More habitat work
- More care for sediment management
- Who should pay in repair/removal situation?
  - Removal vs. restoration costs?

Woolen Mills Dam Removal

Repair/Rebuild total estimate	$3.3 million

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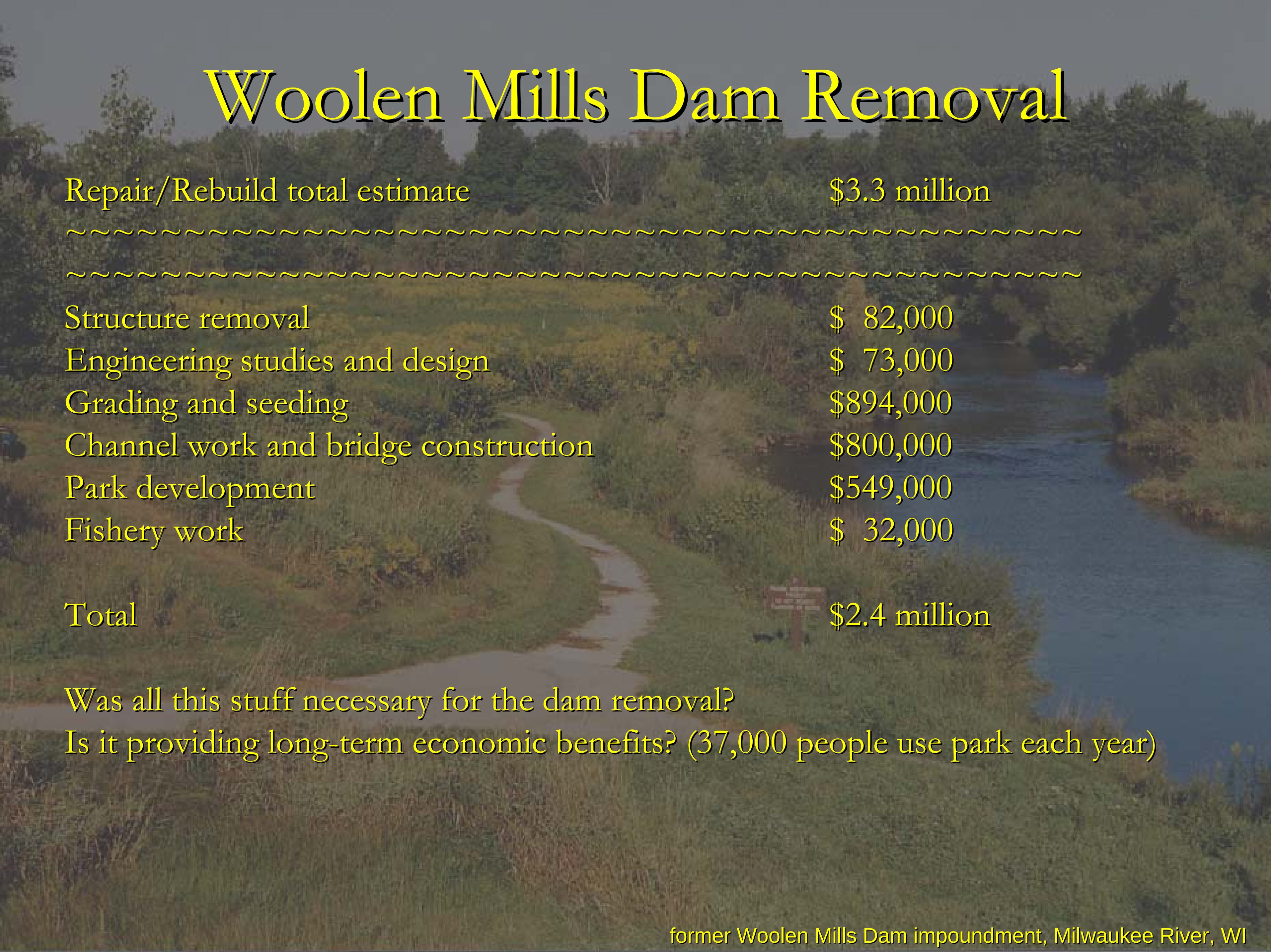
Structure removal	$ 82,000
Engineering studies and design	$ 73,000
Grading and seeding	$894,000
Channel work and bridge construction	$800,000
Park development	$549,000
Fishery work	$ 32,000
Total	$2.4 million

Was all this stuff necessary for the dam removal?

Is it providing long-term economic benefits? (37,000 people use park each year)



former Woolen Mills Dam impoundment, Milwaukee River, WI

Sediment Management, Channel and Riparian Habitat Work

former Silver Springs impoundments, Mill Creek, WI

- Can significantly add to project costs
  - $15,000 vs. $100,000 projects
- Becoming more and more an expectation throughout country
- Other potential expensive costs
  - Sediment contamination management
  - Replacing uses
  - Infrastructure protection or replacement

Recent Massachusetts* Project Costs

Total cost of removal:

Billington Street Dam, Plymouth (2002): $275,000
(8-foot dam, included $135,000 for contaminant management)

Silk Mill Dam, Becket (2003): $210,000
(15-foot dam, included infrastructure challenges)

Upper Cooks Canyon Dam (2006): $45,000
(9.5-foot dam, no sediment or infrastructure challenges, in-kind permitting and oversight)

Robbins Dam, Wareham (2006): $41,000
(6-foot dam, no sediment or infrastructure challenges, in-kind permitting and design, donated construction)

Ballou Dam, Becket (2006): $355,000
(10-foot dam, in progress, construction based on contractor estimate†, includes significant clean sediment management and infrastructure challenges, includes $47,000 to replace water supply)

*Massachusetts costs have been high-end relative to other states due to regulatory process and greater percentage of work done by consultants rather than in-house

†contractors often overestimate removal costs

- consider time and materials construction contracts with a not-to-exceed cost rather than lump sum

Massachusetts Cost Breakdowns

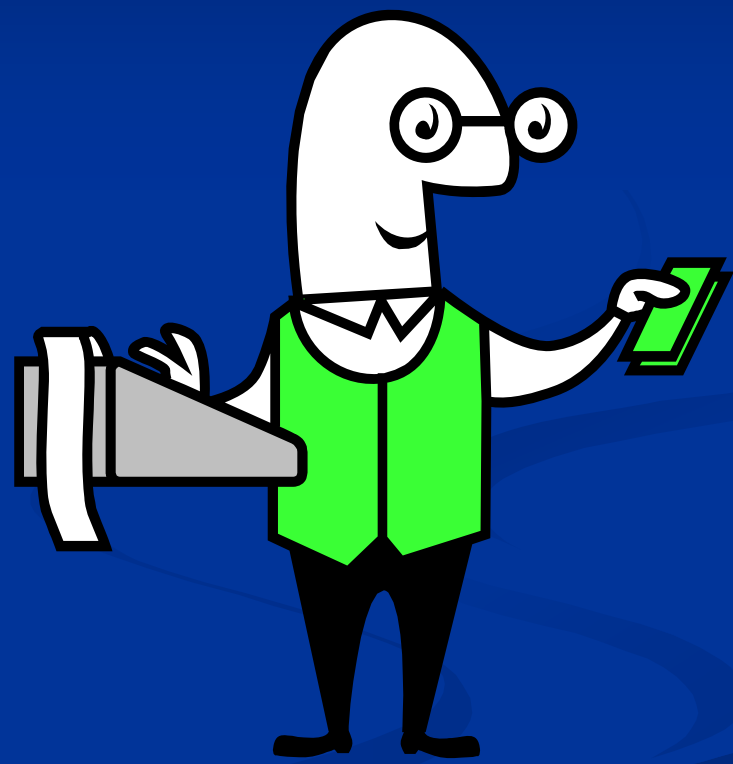
Phase	Range	Median
Feasibility	$15,000 - 145,000	$30,000
Engineering Design	$10,000 - 100,000	$33,000
Permitting*	$4,000 - 80,000	--
Construction†	$35,000 - 290,000	$150,000

*estimated range because work often done in-house with staff time, for significantly less than consultant costs

† includes construction oversight

"Looking only at initial cost figures is not economics, it's *accounting*."

- Ohio State University economist (while rolling her eyes and sneering)



Relief from Maintenance and Repairs

Ontario Dam, Kickapoo River, WI

- Finite design life
  - 50 years (or longer?)
- Continual repairs
  - Cracking concrete, inoperable gates, effective fish passage
  - WI repair & removal fund: 83 dams with $22.5 million in repairs = $270,000 per dam
    - 200-300 dams in need of repair in WI at any time
  - $32 million needed for current repairs at state-owned dams in Massachusetts

Relief from Maintenance and Repairs

Woolen Mills Dam, Milwaukee River, WI

- Continual operations & maintenance costs
  - Keeping gates and other structures operational
  - Inspection costs
  - Security
  - Proper signage
  - Maintaining the property
  - Liability insurance
  - Costs vary: $10,000 - $60,000 per year

Removal is a one-time cost

Relief from Liability: Failure

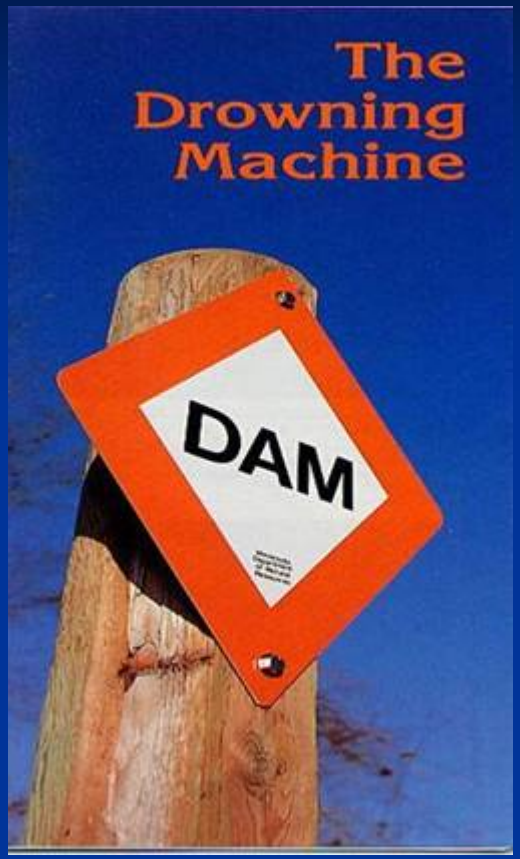
FEMA report to Congress (1999): "Failure of even a small dam releases sufficient water energy to cause great loss of life, personal injury, and property damage."

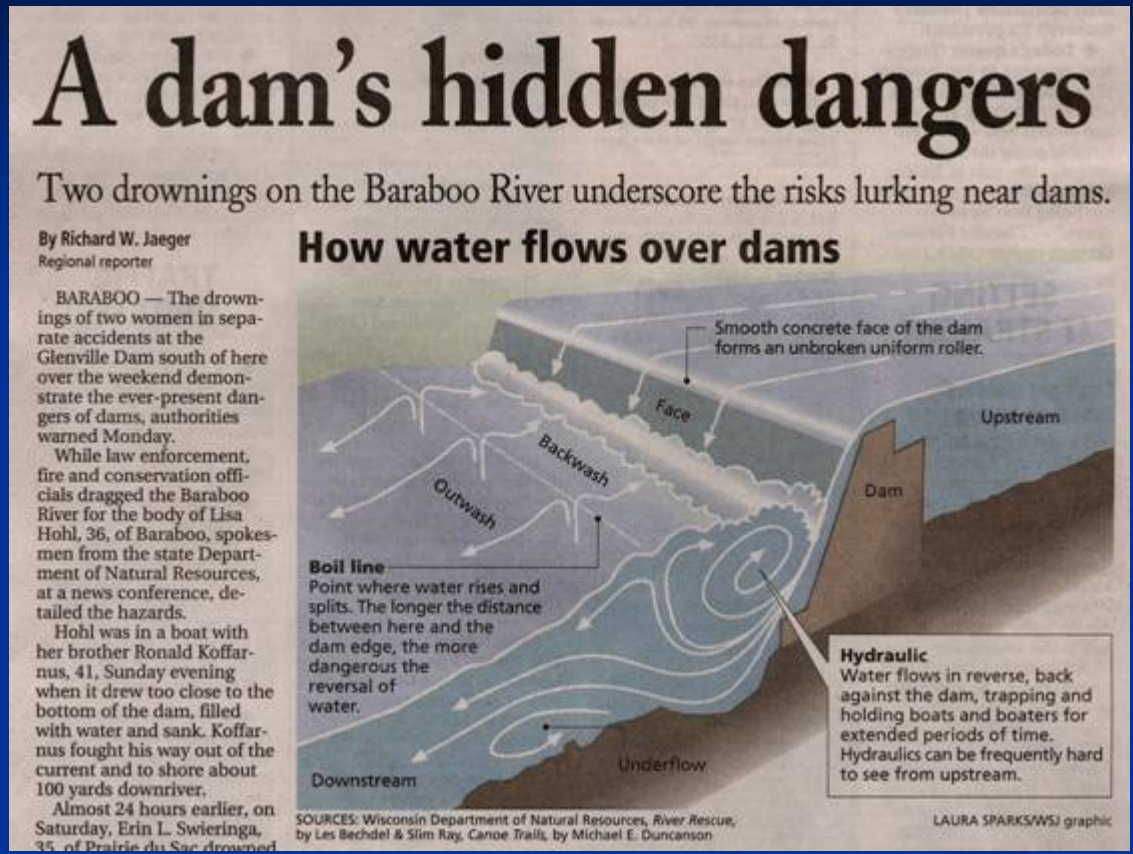
Relief from Liability

failed dam, Chicopee, MA

- NPDP: dam safety costs will be approximately $1 billion per year for next 20 years
  (USCOLD Newsletter, March, 1998)
- Includes:
  - Costs to upgrade unsafe dams
  - Costs of dam failures
  - State dam safety program costs

Relief from Liability: Public Safety





A dam's hidden dangers

Two drownings on the Baraboo River underscore the risks lurking near dams.

By Richard W. Jaeger
Regional reporter

BARABOO — The drownings of two women in separate accidents at the Glenville Dam south of here over the weekend demonstrate the ever-present dangers of dams, authorities warned Monday.

While law enforcement, fire and conservation officials dragged the Baraboo River for the body of Lisa Hohl, 36, of Baraboo, spokesmen from the state Department of Natural Resources, at a news conference, detailed the hazards.

Hohl was in a boat with her brother Ronald Koffarnus, 41, Sunday evening when it drew too close to the bottom of the dam, filled with water and sank. Koffarnus fought his way out of the current and to shore about 100 yards downriver.

Almost 24 hours earlier, on Saturday, Erin L. Swieringa, 35, of Prairie du Sac drowned

How water flows over dams

SOURCES: Wisconsin Department of Natural Resources, *River Rescue*, by Les Bechdel & Slim Ray, *Canoe Trails*, by Michael E. Duncanson

LAURA SPARKS/WSJ graphic

- Insurance companies charge rates according to worst-case scenarios because of risk uncertainty (FEMA 1999)
  - $5,000 to $15,000 annually for high hazard dams in WI
  - Expensive for private owners

“Attractive Nuisance”


“Attractive Nuisance”
Small Child
Law Suit!
Board wedged into dam!
9'99

Dam Removal Liability

Ballou Dam, Yokum Brook, MA

- Draining wells
- Downstream sediment
- Infrastructure damage

- Proper planning and management can alleviate these concerns
- Have designs stamped by licensed professional engineer

Relief from Impoundment Management

Mounds Dam impoundment, Willow RIver, WI

- Dredging
  - Costs vary
  - ~ $200,000 to $700,000 for 30 to 100 acre impoundment
- Harvesting vegetation
  - Less expensive but done more often
- Does not permanently fix problem

Relief from Certain Fisheries Management Costs

- Localized habitat work
- Stocking
  - Tomorrow River, WI
  - Kickapoo River, WI
    - Both have had stretches of river re-classified as Class I trout water after dam removals
- Endangered species

Opportunities?
Perceived Losses in Recreation

- Have been overcome by thoughtful planning in some cases
  - Thoughtful planning may be necessary
- Replace impoundment recreation with river-based recreation
  - For small dams, often with greater economic value

Opportunities: Fishing

Tomorrow River following Nelsonville Dam removal, WI

- Not just putting fish back where there were none: different economic values (Walsh, et al. 1992):

  Salmon > Trout > Bass or Pike > Carp

  River system > Coldwater > Warmwater > Impoundment

- Economic vs. social value
- Anglers spend $38 billion per year on fishing
- Total economic activity = $108 billion annually
  - More than the combined gross state products of MT, ID, WY, ND and SD

Ripple Effect

- Every dollar spent by an angler increases another person's income, enabling that person to spend more, increasing another person's income and so on
- Results in total economic activity

Opportunities: Boating

former Edwards Dam impoundment, Kennebec River, ME

- Canoeing/kayaking
  - $100 million annual sales
  - Kayaking is among fastest growing outdoor activities
- Kickapoo River, WI
  - Following Ontario Dam removal (early 1990s)
  - Non-local canoeists now spend $1.2 million per year on boat rentals, lodging, gas, and other items in economically depressed area
- Baraboo River, WI
  - After 3 recent dam removals near downtown Baraboo:
  - New business is supplying 70-80 boat shuttles per weekend day in summer
- Finding free-flowing stretches is a challenge – scarcity can increase economic value

Opportunities: Boating

- Apple River, WI
  - Several new tubing and camping businesses since Somerset Dam removal

former Somerset Dam impoundment, Apple River, WI

Opportunities: Community Revitalization

"Having a hard time revitalizing your downtown? You may want to consider knocking the dam down."

--Wall Street Journal, October 18, 2000

- Dam removal can serve as catalyst for communities
- Example: Edwards Dam removal, Kennebec River, ME

Opportunities: Community Revitalization

Downtown

Baraboo, Wisconsin

BEFORE

AFTER

Next to former Oak Street Dam, Baraboo River, WI

Opportunities: Local Businesses

former Woolen Mills Dam impoundment, Milwaukee River, WI

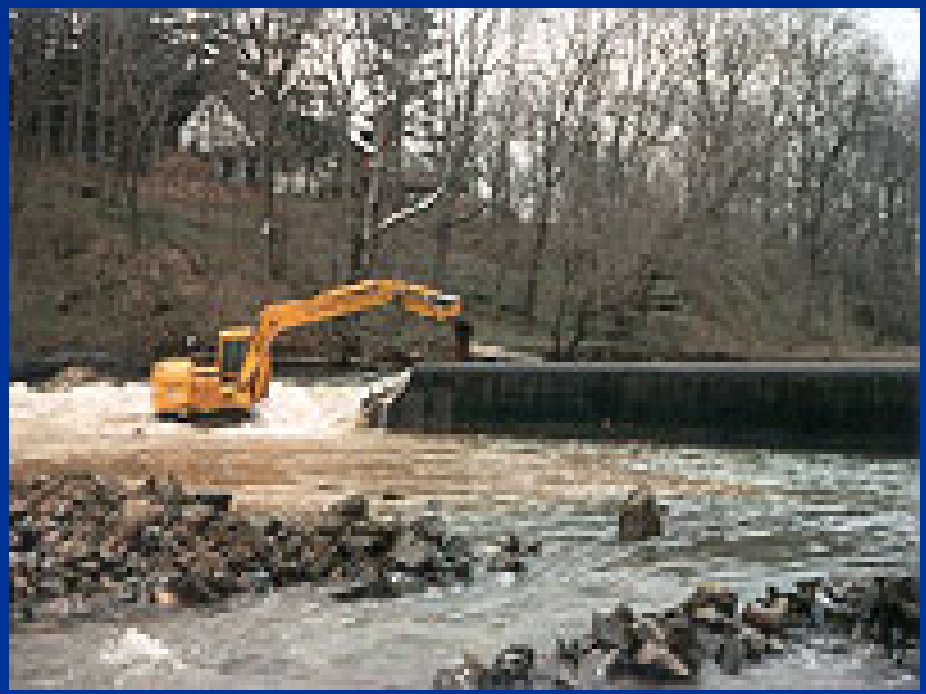
- Increased use of the area translates to more activity and exposure for businesses
- Improved quality-of-life – helps recruit and keep employees

Opportunities: Improve Aesthetics

- Uncovering waterfalls, riffles (Value-laden)

site of former Willow Falls Dam, Willow River, WI

Opportunities: Cost-Effective System-wide Restoration



Rock Hill Dam removal, Conestoga River

- Conestoga River, PA
  - 17 dam removals for under $1 million since 1996
  - Return of American shad – had been absent for 88 years
  - Expected to generate $2 – 3 million per year

Summary of Repair vs. Removal Considerations

Costs

- Project costs: repair vs. removal
- Operations and maintenance
- Liability – failure, safety

Benefits (may not be zero for either repair or removal)

- Recreation (boating, fishing, access, walking paths, parks)
- Economic activity (attracting people to area)
- Water quality and property values
- Ecological value

Look at long-term costs and benefits (10-year or 30-year projections)

Consider grant funding availability

Good reference: Dam Repair or Removal: A Decision-Making Guide
http://www.ies.wisc.edu/research/wrm00/econ.htm

Some Economic FAQs

- Who owns the land under impoundment?
- Property values
- Who pays for project?

Grant Funding for Dam Removal

- Few grants available for repair because private benefits
- Many grants available for restoration because public resource benefits

- May be most significant determining factor in dam removal economic equation

Property Values

- What we know:
  - Land values are tied to water quality
    - Impoundment water quality is often poor
    - Neponset Reservoir, MA – 40% decline in value (Jobin 1998)
    - St. Alban's Bay, VT – 20% decline in value (Young 1984)
    - Maine lakes – 5% decline in value with every meter visibility depth lost (Bouchard, et al. 1996)
  - Proximity to 'open space' is important (Miller 1992 and others)

Property Values

former Woolen Mills Dam impoundment, Milwaukee River, WI

- What we don't know:
  - Proximity to impoundment vs. river open space
- More research needed
  - One of the most significant issues
  - How much will the research matter?

Property Values

Felton Lake Dam impoundment, Housatonic River watershed, MA

Provencher (2006-submitted) study based on hundreds of property sales at 14 millpond dam removal sites in southern Wisconsin:

- No impact of dam removal on resale values of waterfront properties relative to properties on intact impoundments
- The most valuable properties were at sites where the river has been free-flowing for at least 20 years
- Property values around small impoundments decrease as you get closer to the water (some confirmation for water quality issue?)

Research Needs

Kamrath Creek dam drawdown, WI

- Long-term effects on businesses
- Long-term effects on communities
- Long-term effects on individuals (property values)
- Timescales: long-term versus short-term

Final Comments

Franklin Dam removal, Sheboygan River, WI

- Not all or even most potential economic benefits will occur at all small dam removals
- May be dependent on treatment of former impoundment
- Much research is needed to get a firm grasp on these issues and to help foster well-informed decision-making processes
- Dam removal is often financially favorable to repair, both from initial cost comparison and long-term costs/benefits

Dam Removal Project Bidding and Scoping

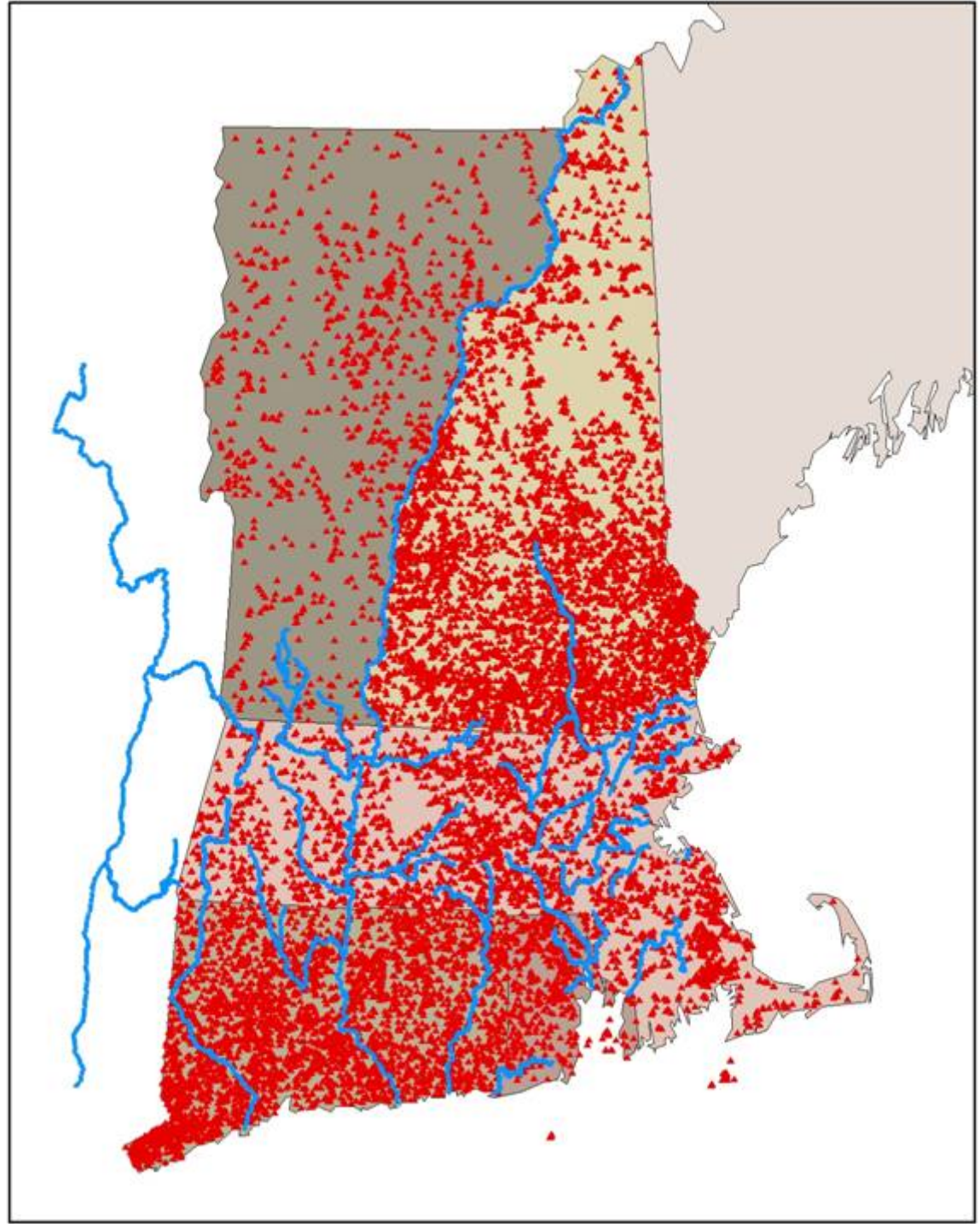
Lower Cooks Canyon Dam, Galloway Brook, MA

Outline

- Phasing projects
- Bidding projects
- Scoping projects
- Hiring consultants
- Winning bids

The Market for Dam Removal

- 13,126 Dams in CT, RI, MA, VT, NH
- Aging dams are taking themselves out and we have no control over sediment release, flooding, etc.
- Find a process that allows for cost-effective, proactive removals



Project Phasing

- Feasibility
- Engineering
- Permitting
- Construction

This is one approach:

- Some states lump phases
- Some states do work in-house (no consultants)

Bids and Scopes

Bid Request – request for consultants to provide qualifications, proposed scope of work, personnel, schedule, and costs

- RFR – Request for Responses
- RFP – Request for Proposals
- RFQ – Request for Qualifications

Scope of Work – agreement between hiring entity and consultant on specific task items, costs, project schedule

- Covers everyone's expectations – consultant and proponent

Consultant Hiring Process

- Issue Request for Qualifications/Proposal
  - try to get at least three responses
- Respond to consultant questions
- Review responses
- Clarifying questions for consultant
- Complete review and generate short list
- Interviews
- Preliminary selection and negotiation
- Selection and contracting

Don't always need all these steps

Samples (see handouts)

- Sample bid requests
  - Request integrated qualifications: engineers, ecologists, geomorphologists, regulatory experts, landscape architects
- Sample scopes of work
  - Scope should reflect scale of project

One approach:

- Simple bid request – express goals of project, but not details
- Detailed scope of work
  - Negotiated between hiring entity and consultant
  - Covers both hiring entity and consultant for exact performance

Consultant Negotiation

- From consultant side:
  - Two aspects:
    - Meet goals of project
    - Fulfill each task item
  - Need to cut entire tasks or take entirely different approach for a task with different expectations; or stand firm
- From proponent/client side:
  - Negotiation doesn't involve asking for lower costs per task
  - Rearrange tasks or eliminate tasks, either because you don't need them or because you can find another way to accomplish them
- Critical to have enough funds budgeted for work before bid request – otherwise won't get good applicants

What to Look for in a Consultant

- Integration of skills
  - Engineering, geomorphology, ecology (and experience with this integration)
  - Permitting
  - Presentation skills
  - No one firm is truly good at all of these
    - Require subconsultants

What to Look for in a Consultant

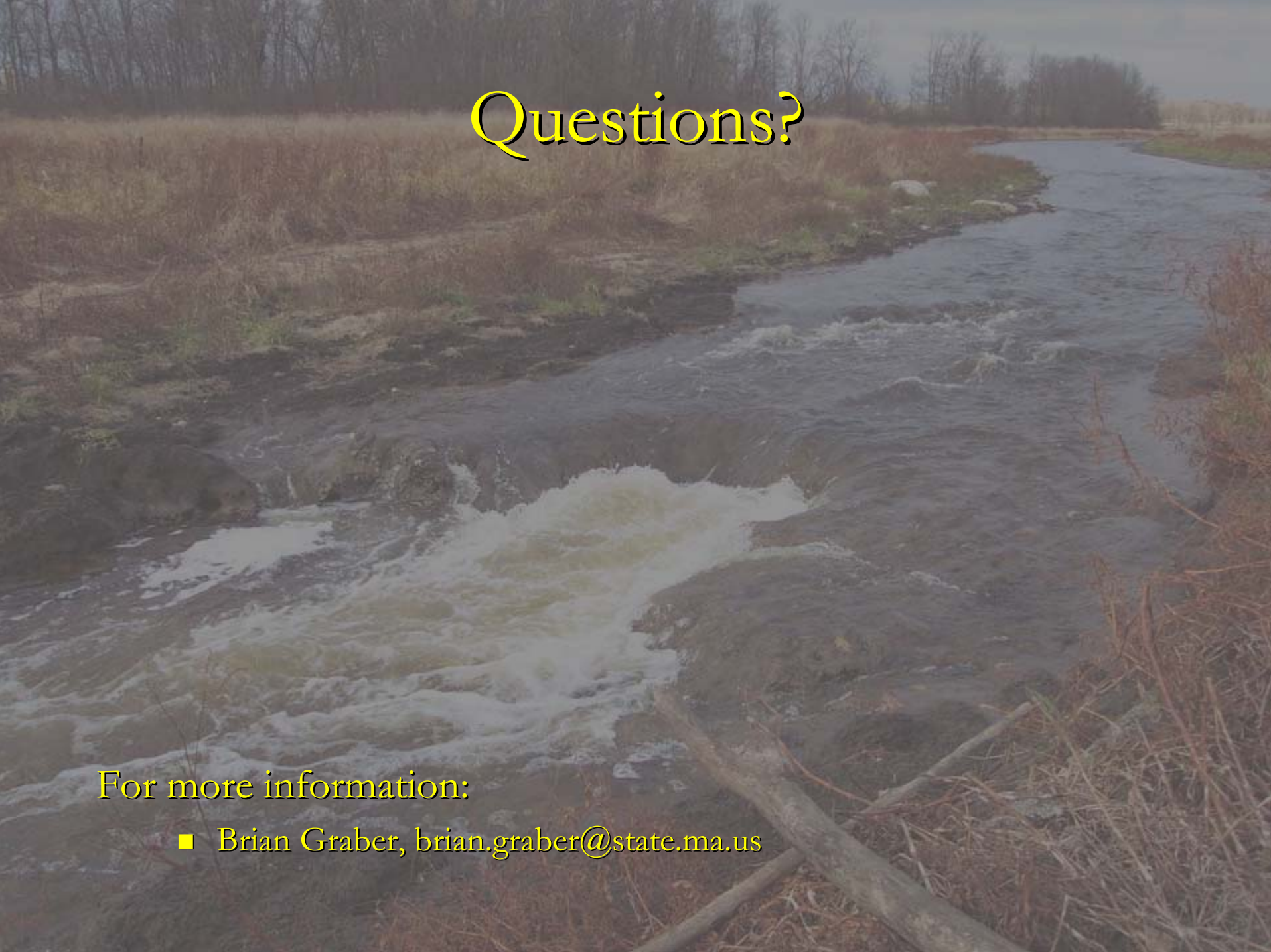
- Experience
- Willingness to advocate for project and resource
  - See things the client doesn't
  - Question client's approaches if it will improve the resource
- Check unlisted references
  - state and federal agencies work with a lot of consultants
- Best value = low cost + best qualified
  - Rate both qualifications and cost
  - For dam removal especially, low cost may be a result of lack of understanding
- Make use of partner resources on review team
  - American Rivers, federal and state agencies have a lot of experience with dam removal

How to Win a Bid

- Visit site
- If allowed, call proponent and discuss project
- Present restoration approach
  - Not just specific models (HECRAS, surveying techniques, HEC-6)
  - Project needs more than engineering competence
  - Show concern for the ecosystem – our biggest concern is that we will hire engineers who will do a fine job with the structural work, but will do a poor job on habitat work, public presentations, and permitting
- Show experience with similar projects
  - Winning bids with minimal experience
    - Price
    - Creativity
    - Research
    - Subconsultants

How to Win a Bid

- Subconsult
  - Show integration with subconsultants
- Show enthusiasm
  - bid responses are reviewed by a range of people
- Price – may be most significant factor
  - Present cost to complete minimum work, and…
  - Present optional tasks with itemized cost figures



Questions?

For more information:

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